Hydrological summary

for the United Kingdom

July 2000

General

July was a dull and relatively cool month which, for the UK as a whole, added to a cluster of dry Julys – only 1998 being above average in the last seven years. Below average evaporative demands helped maintain very healthy reservoir stocks for England and Wales remain very healthy. However, stocks are low in parts of Northern Ireland and western Scotland where a three-month drought at a time of increased seasonal water demand has caused water supply difficulties – late in the month ferries were used to augment supplies on Tiree in the Western Isles. Localised urban flooding was common in July and monthly runoff totals were exceptionally high in parts of the English lowlands – for spring-fed rivers especially - but flows were depressed in many northern catchments. Groundwater level recessions are well under way but late summer levels are appreciably above average in most major outcrop areas.

Rainfall

Despite an unsettled complexion to the weather, significant rainfall in July was restricted to a few days in most regions. However, thunderstorms produced a number of exceptional, but localised, falls. Intense rainfall in the Pennines (including 55 mm in an hour at Chaddesdon, Derbyshire) and Cumbria triggered local flooding on the 2nd; Chester was also deluged during a very brief electrical storm. On the 4th, a slow-moving frontal system moving up from the English Channel produced substantial rainfall across much of the South including 24-hr storm totals of 92.4 mm at Bishop's Sutton (Hants) and an unofficial 124 mm at Worthing (return period >100 yrs); near Bristol a landslide blocked the main rail link to London. Much of the country reported only traces of rainfall over the 15 days beginning around the 13th, before a wet end to the month. The showery nature of the July rainfall made for large spatial variability in monthly totals. Belfast recorded 62 mm in three and a half hours on the 28th – by contrast, nearby Aldegrove had its lowest July rainfall in a series from 1926. A few areas (e.g. in the Cheshire Plain) reported July rainfall of over 200% whereas parts of Scotland's coastal fringe recorded < 30%. Provisional figures indicate that Scotland had its third driest July since 1955. In western Scotland (the islands especially) - and in parts of Northern Ireland - a significant drought can be traced back to March. Whilst Scotland had its third lowest May-July rainfall in the last 50 years, regional rainfall totals for England and Wales were close to average. For the year thus far, rainfall in all regions is within the normal range.

River flows

In most river basins, July witnessed sustained recessions interrupted by occasional short-lived spates. More threatening were locally intense runoff events caused mostly by thunderstorms. local drainage systems were overwhelmed causing considerable damage and transport disruption e.g. in Worthing and Belfast. Away from the towns, dry soils were a moderating influence but the seasonally very high baseflows made many English lowland rivers vulnerable to intense or sustained storms. The Rivers Rother (Hants) and Arun (Sussex) were amongst those which exceeded bankfull (on the 5th) and most rivers draining Chalk catchments registered well above average July runoff. The Hampshire Avon, Test and Itchen each established new July runoff maxima (in records exceeding 35 years). By contrast rivers draining much of the Scottish Highlands - which respond rapidly to a lack of rainfall - reported monthly runoff totals in the lowest quartile. The July mean flow for the River Luss closely approached the lowest on record, and that for the Ness (at Ness-side, Highland Region) was unprecedented. Some rivers draining the western Highlands (e.g. the Carron and Ewe) established new April-July runoff minima – this has significance in a region where many communities are dependent on smaller rivers and burns. Runoff totals for the year thus far, and over the last twelve months, are above average for most areas – exceptions include low-lying catchments in eastern England and the River Annacloy in Northern Ireland where the January-July total is the lowest on record.

Groundwater

Soil moisture deficits at the end of July were exceptionally high in the Western Isles but generally within the normal late summer range throughout the main aquifer outcrop areas (local variability was however large). Some isolated infiltration was reported in July (e.g. to the Greensand in parts of Surrey). This represented only a modest boost to recharge but infiltration totals over the last four months throughout most of the English lowlands are more than twice the long term average. The unusual spring and early summer recharge is reflected in the well above average groundwater levels throughout the Chalk. Except in the slowest responding wells (e.g. Therfield) levels fell briskly in July but remain well above the summer average in most outcrop areas – Killyglen in Northern Ireland is an exception. Levels in the Lincolnshire Limestone remain close to the maximum on record but are near to or modestly above the July average in most other limestone index wells. The wide geographical spread of the Permo-Triassic sandstones outcrops is reflected in the range of borehole responses – levels in the west are mostly very healthy but remain low in a few eastern outcrops.

Centre for Ecology & Hydrology
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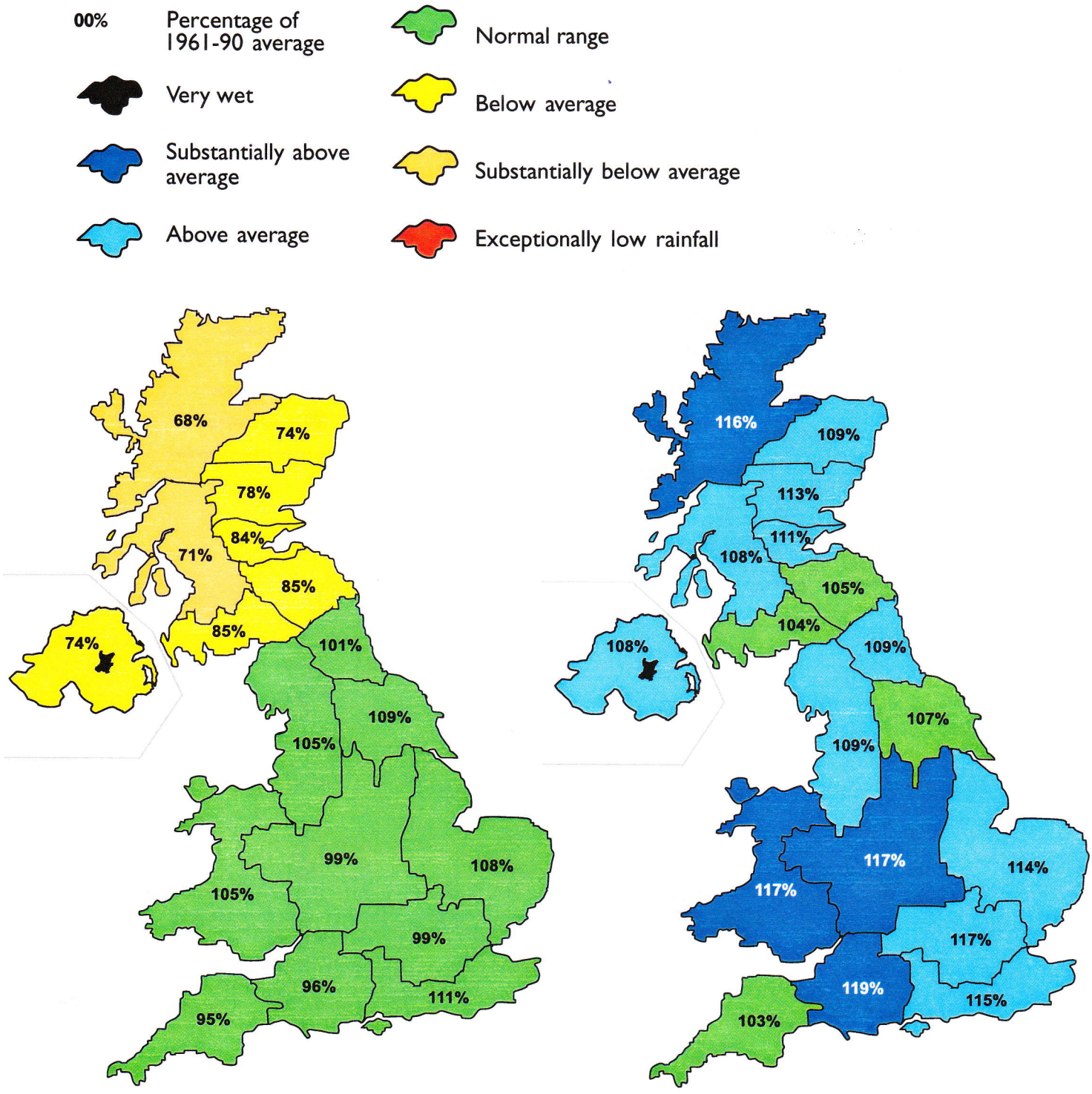
Rainfall accumulations and return period estimates

Area	Rainfall	Jul 2000	May 00-Jul 00	RP	Jan 00-Jul 00	RP	Aug 99-Jul 00	RP	Aug 98-Jul 00	RP
England & Wales	**mm**	**63**	**189**		**491**		**1000**		**1960**	
	%	**101**	**99**	**2-5**	**104**	**2-5**	**112**	**5-10**	**109**	**5-10**
North West	mm	83	254		662		1306		2616	
	%	98	105	2-5	109	2-5	109	2-5	109	5-10
Northumbrian	mm	59	189		503		930		1843	
	%	91	101	2-5	110	2-5	109	2-5	108	2-5
Severn Trent	mm	58	170		431		881		1732	
	%	110	99	2-5	105	2-5	117	5-10	115	10-20
Yorkshire	mm	65	195		481		875		1741	
	%	110	109	2-5	108	2-5	107	2-5	106	2-5
Anglian	mm	54	160		348		680		1343	
	%	110	108	2-5	106	2-5	114	5-10	113	5-10
Thames	mm	46	159		403		804		1552	
	%	93	99	2-5	107	2-5	117	5-10	113	5-10
Southern	mm	51	173		437		898		1678	
	%	107	111	2-5	108	2-5	115	5-10	108	2-5
Wessex	mm	54	163		475		995		1885	
	%	103	96	2-5	107	2-5	119	5-10	112	5-10
South West	mm	69	200		564		1204		2457	
	%	100	95	2-5	91	2-5	103	2-5	105	2-5
Welsh	mm	86	250		719		1531		3003	
	%	112	105	2-5	108	2-5	117	5-10	114	10-20
Scotland	**mm**	**50**	**184**		**781**		**1581**		**3303**	
	%	**54**	**69**	**10-20**	**109**	**2-5**	**110**	**5-10**	**115**	**30-45**
Highland	mm	45	200		1034		2035		4166	
	%	43	68	10-20	120	5-15	116	5-15	118	50-80
North East	mm	39	154		539		1064		2094	
	%	54	74	5-10	106	2-5	109	2-5	108	5-10
Tay	mm	57	183		694		1393		2861	
	%	74	78	2-5	108	2-5	113	5-10	116	20-30
Forth	mm	65	184		641		1226		2540	
	%	86	84	2-5	113	2-5	111	5-10	114	10-20
Tweed	mm	65	178		538		1014		2094	
	%	89	85	2-5	105	2-5	105	2-5	108	5-10
Solway	mm	71	221		738		1482		3235	
	%	79	85	2-5	104	2-5	104	2-5	114	10-20
Clyde	mm	66	209		882		1834		3915	
	%	60	71	5-15	106	2-5	108	2-5	115	20-35
Northern Ireland	**mm**	**40**	**154**		**477**		**1141**		**2323**	
	%	**59**	**74**	**5-10**	**87**	**2-5**	**108**	**2-5**	**110**	**5-10**

RP = Return period

 All monthly totals since July 1998 are provisional (see page 12). Recent monthly rainfall figures for the Scottish regions have been compiled using data provided by the Scottish Environment Protection Agency. The return period estimates are based on tables provided by the Meteorological Office (see Tabony, R.C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered); RP estimates for Northern Ireland are based on the tables for north-west England. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past. *See page 12.

Rainfall . . . Rainfall . . . Rainfall

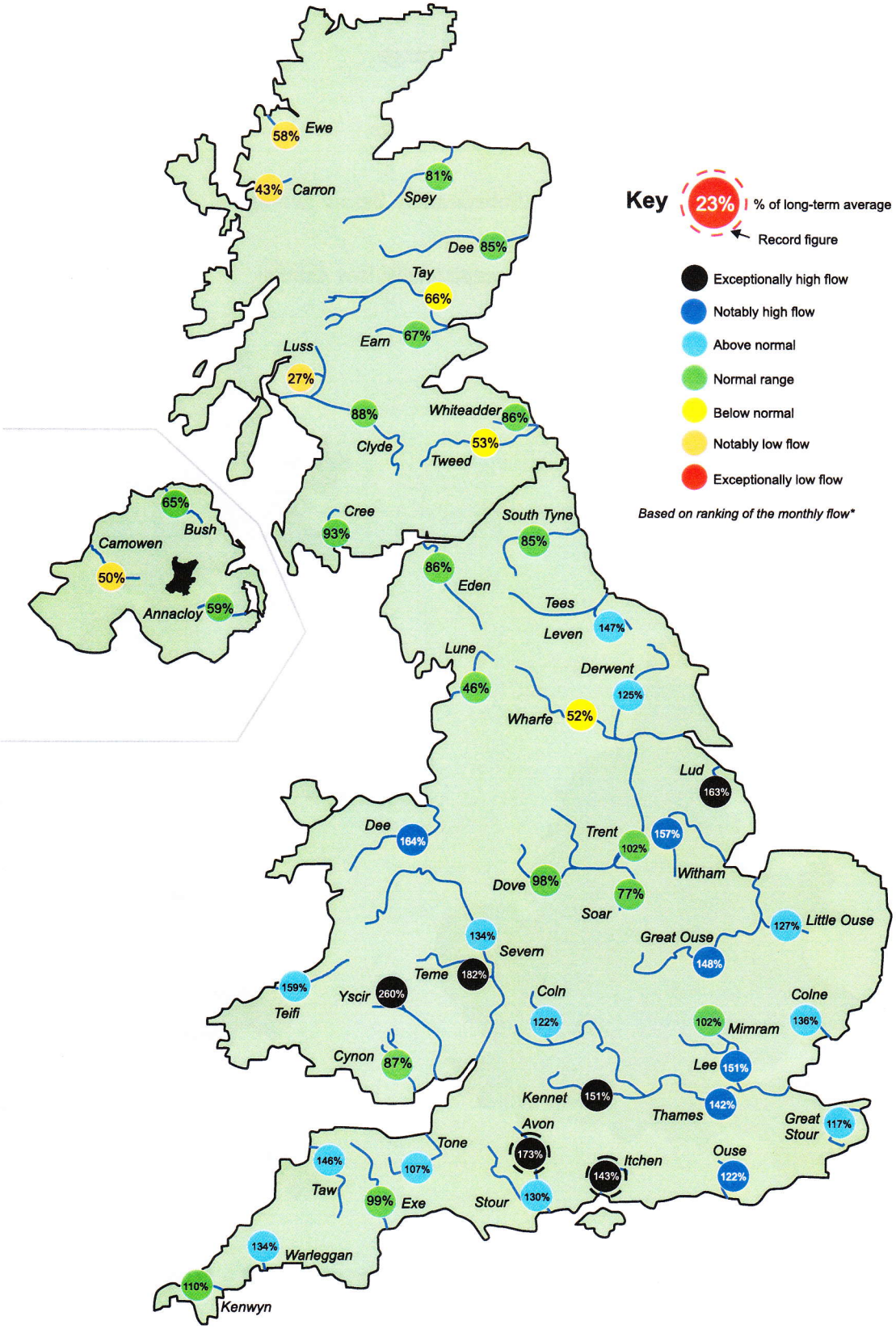


May 2000 - July 2000

August 1999 - July 2000

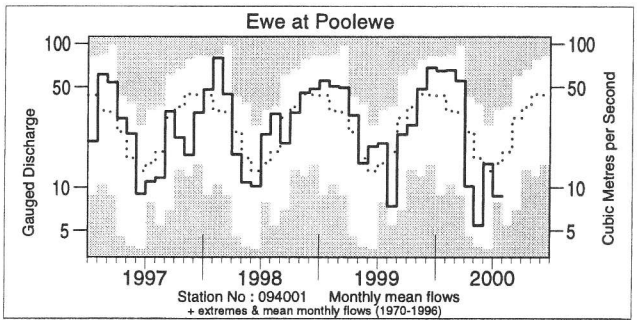
Rainfall accumulation maps

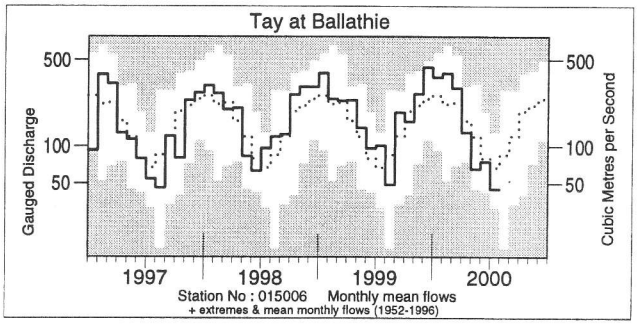
Following one of the wettest winters on record in northern and western Scotland, the May-July period was the driest in many areas since the very severe drought of 1984. The counterbalancing effect of the dry and wet periods is evident in the percentage rainfall totals for the last 12 months. Rainfall for August-July was appreciably above average in all regions and, for the UK as a whole, ranks among the five wettest in more than 50 years (1998/99 was wetter however).

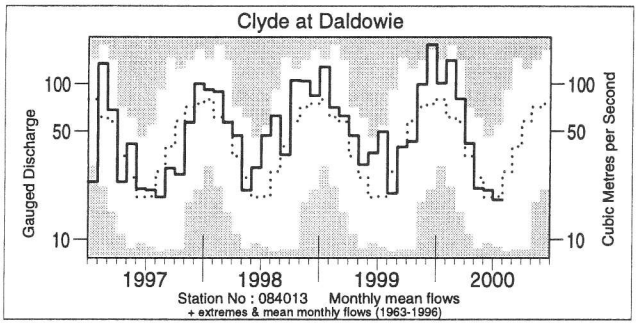


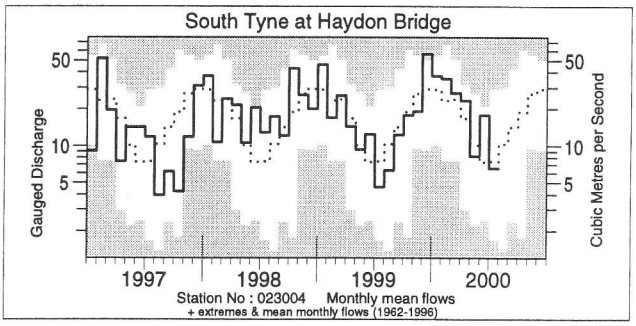
River flows - July 2000

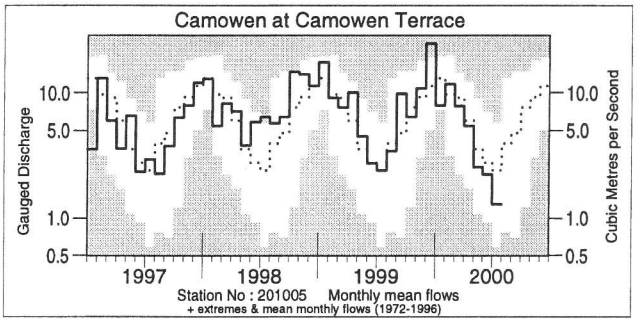
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station.

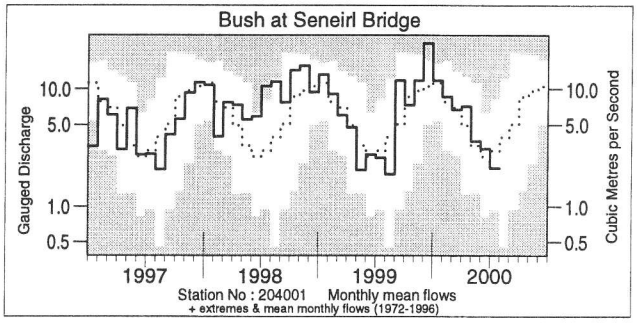


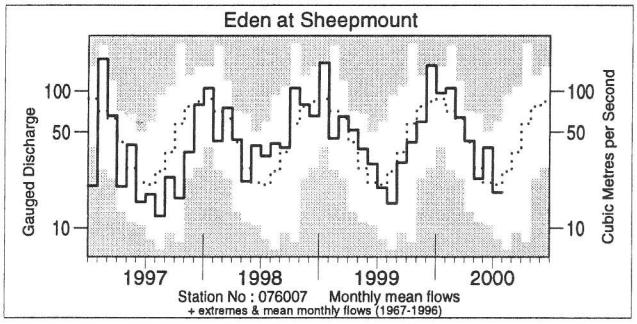


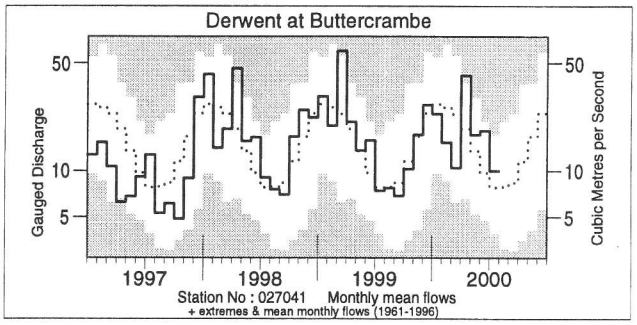


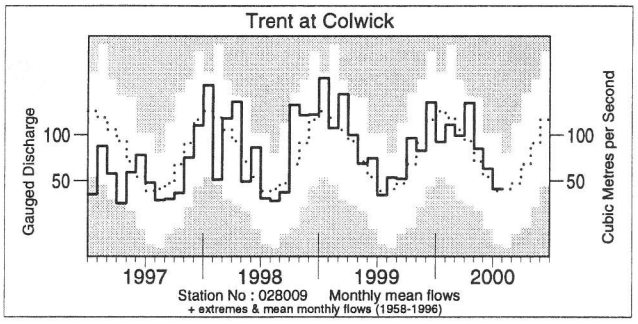


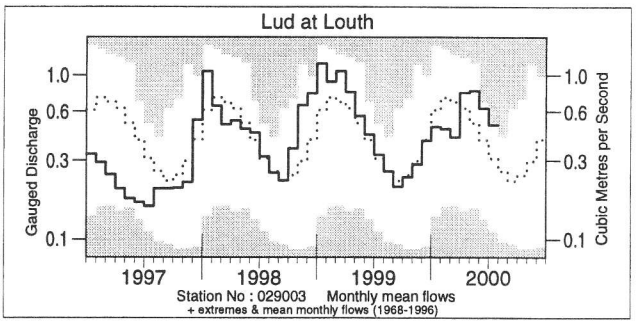








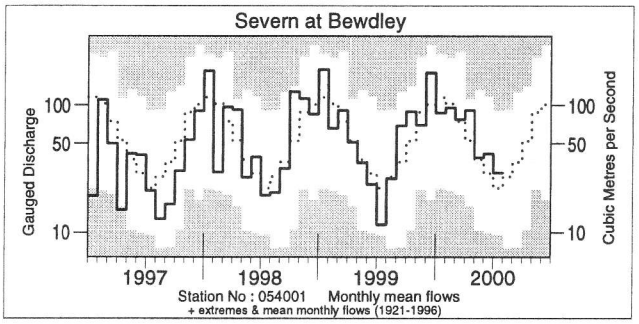


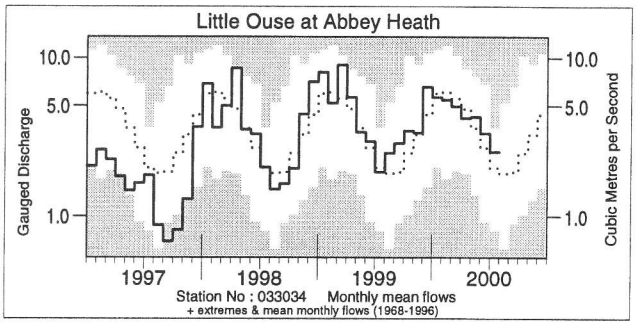


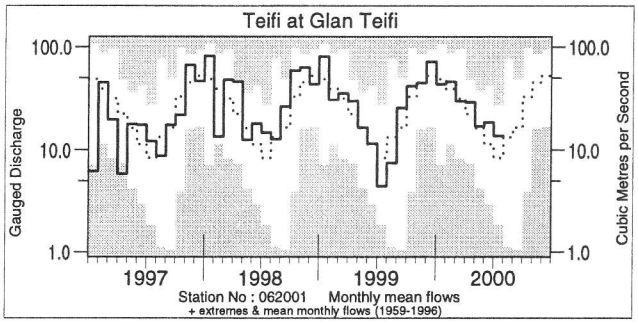
Monthly river flow hydrographs

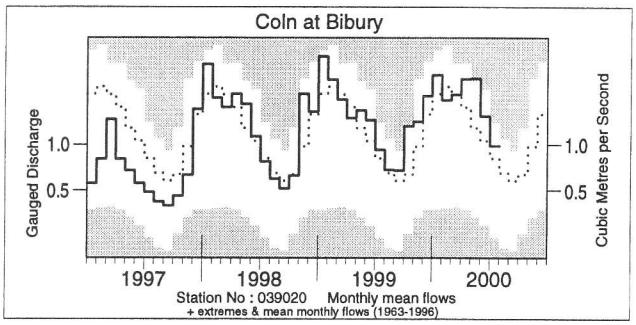
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1997 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

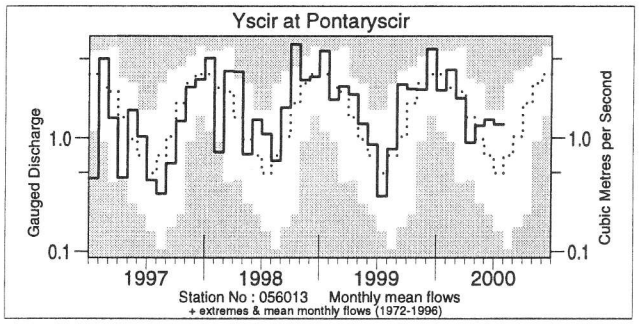
River flow . . . River flow . . .

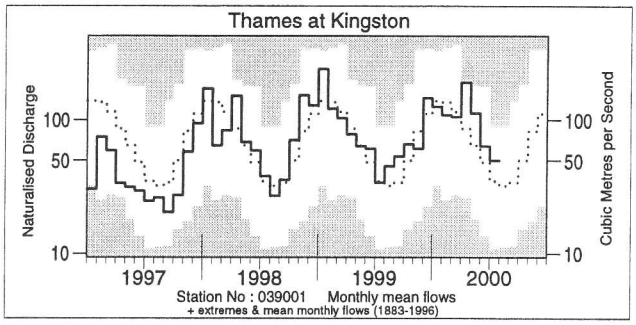


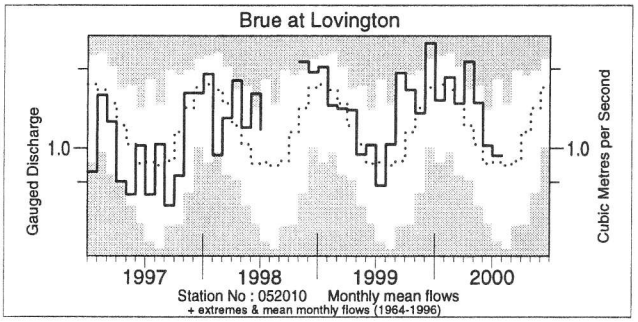


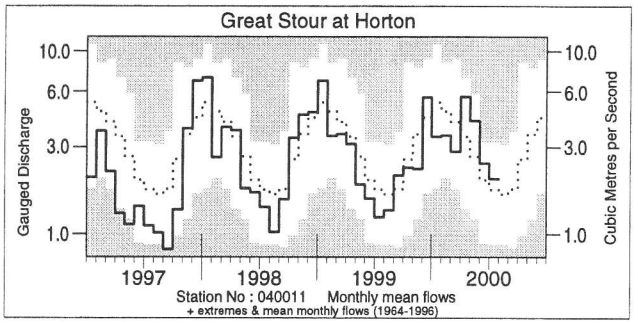


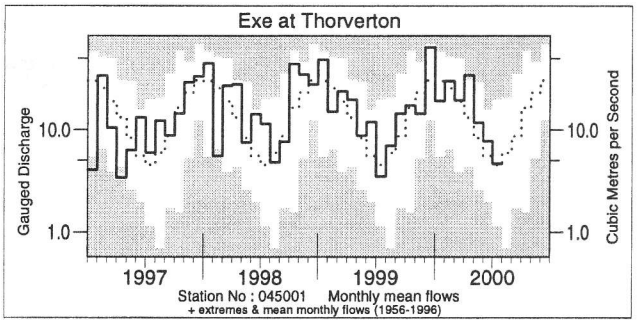


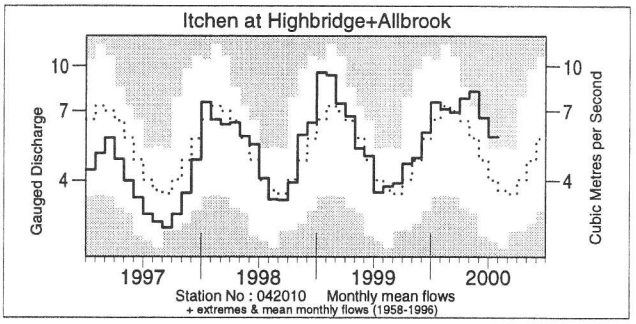










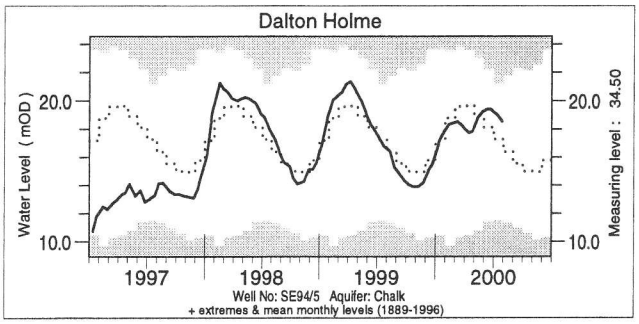


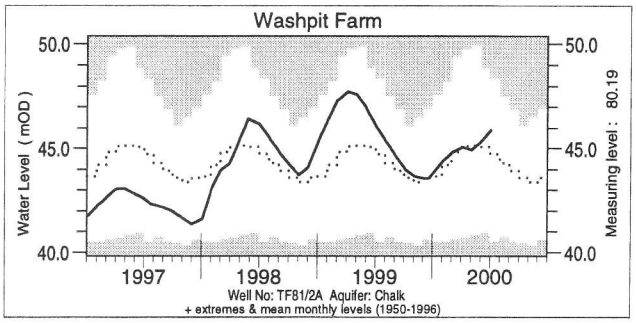
Notable runoff accumulations April - July 2000 (a); January 2000 - July 2000 (b)

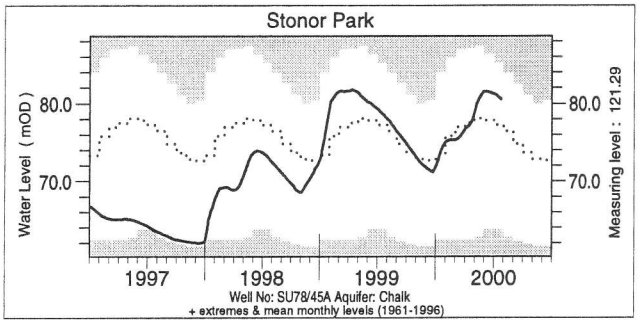
	River	%lta	Rank	River	%lta	Rank	River	%lta	Rank
(a)	Leven	264	40/40	Test	144	42/42	Teme	196	31/31
	Blackwater	188	48/48	Itchen	135	42/42	Carron	69	1/22
	Kennet	166	39/39	Avon	171	36/36	Ewe	57	1/30
	Lymington	220	40/40	Brue	229	36/36	(b) Annacloy	69	1/21

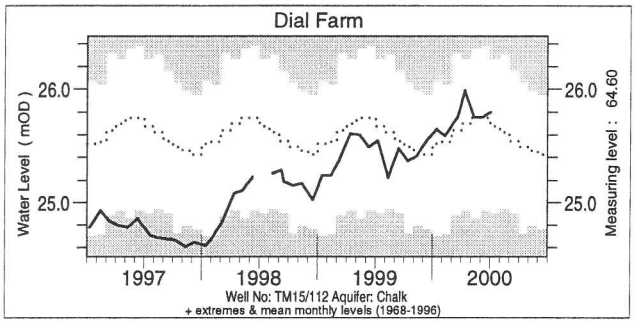
lta = long term average
Rank 1 = lowest on record

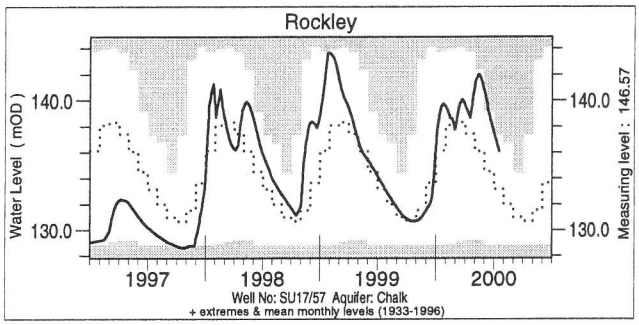
Groundwater . . . Groundwater

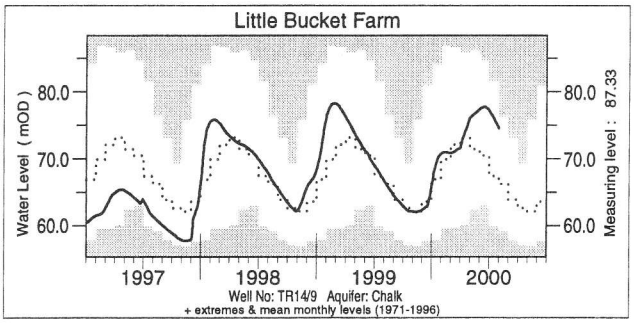


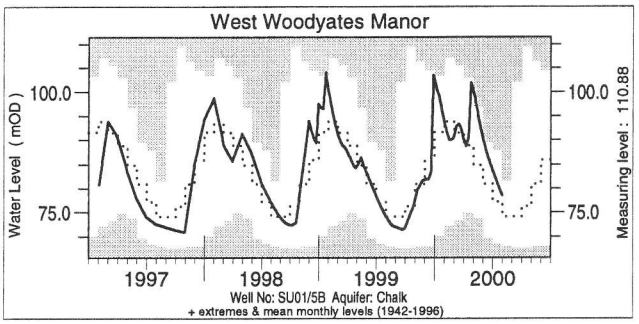


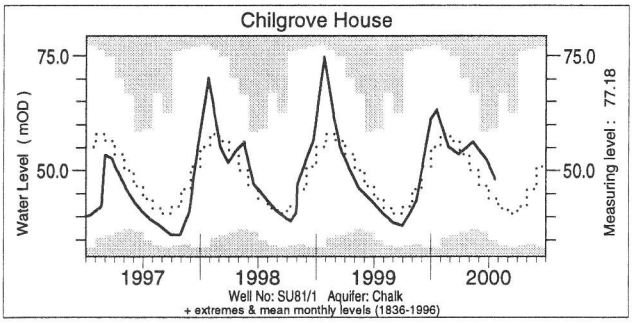


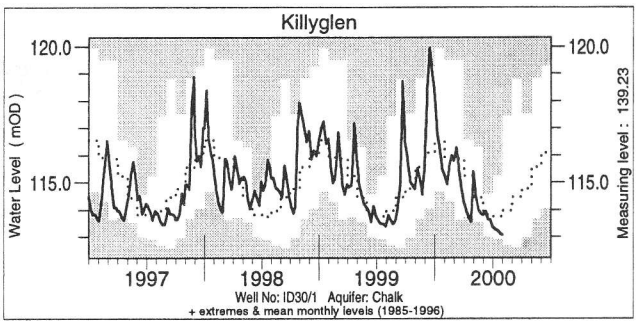


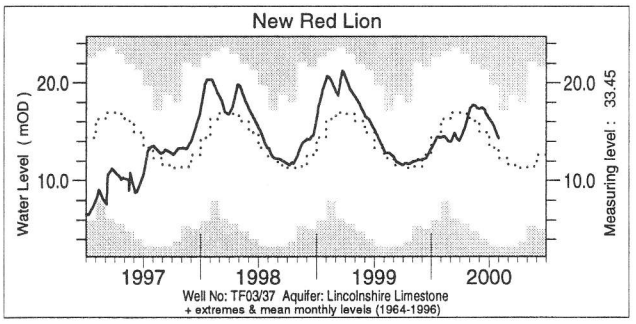






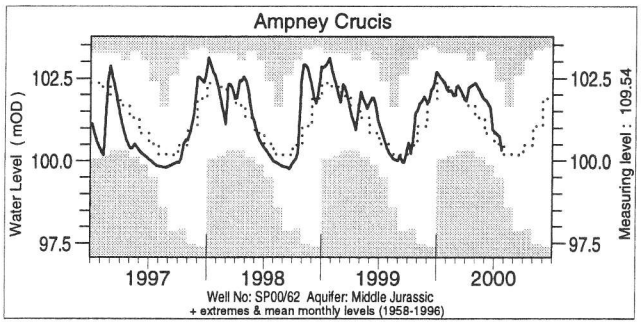


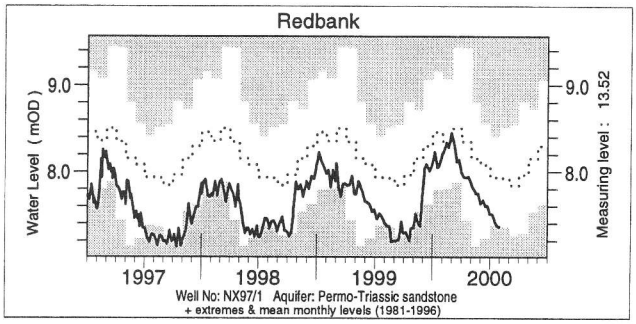


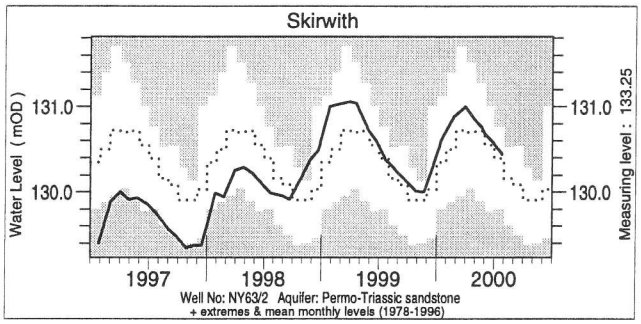


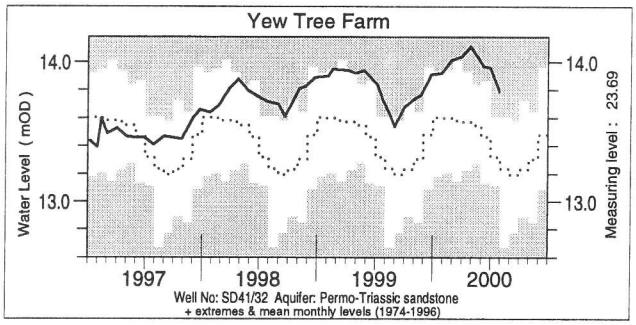
Note. Due to the impact of abstraction on groundwater levels at the Holt, it has been replaced as an index site by the Stonor Park well. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs, note that most groundwater levels are not measured continuously — the latest recorded levels are listed overleaf.

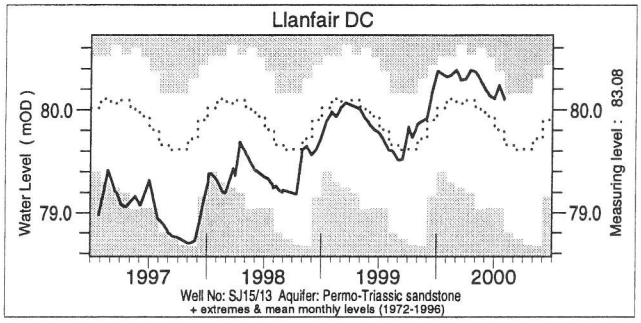
Groundwater . . . Groundwater

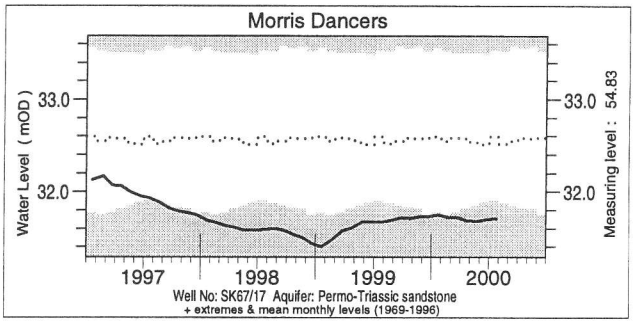


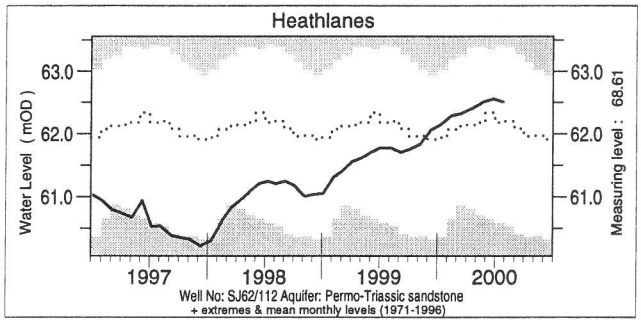


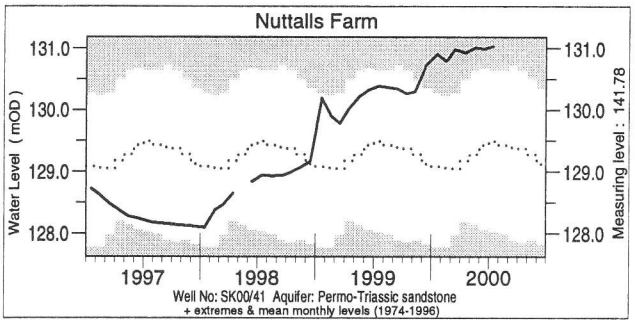


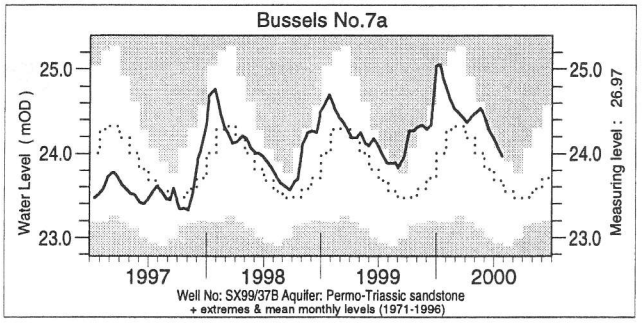


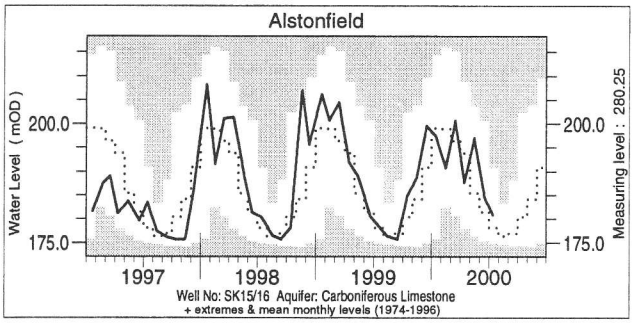








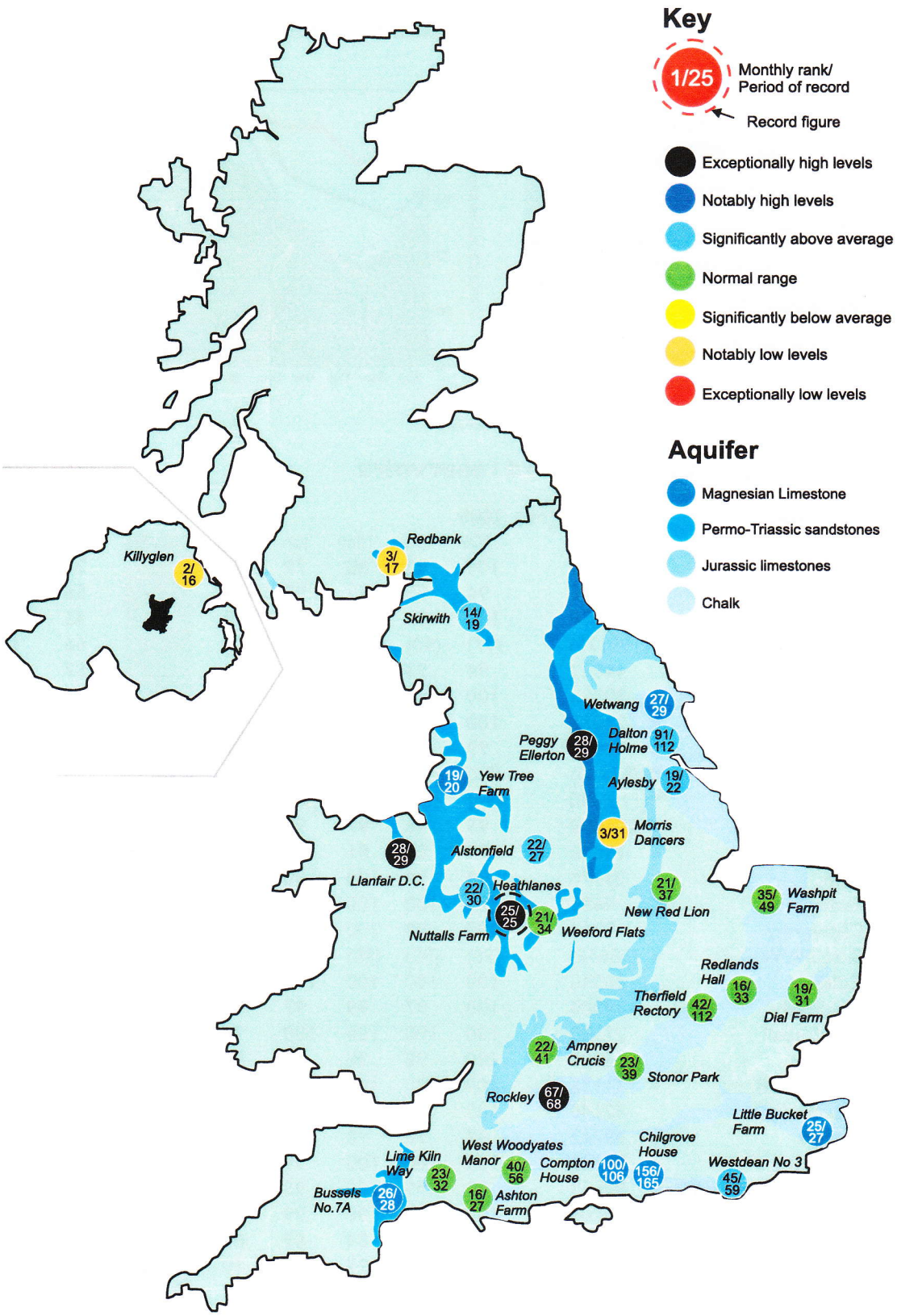




Groundwater levels July/August 2000

Borehole	Level	Date	Jul av.	Borehole	Level	Date	Jul av.	Borehole	Level	Date	Jul av.
Dalton Holme	18.56	27/07	17.18	Chilgrove	48.16	21/07	43.56	Llanfair D.C.	80.10	01/08	79.66
Washpit Farm	45.90	04/07	44.73	Killyglen	113.07	31/07	113.84	Morris Dancers	31.71	25/07	32.42
Redlands Hall	41.62	27/07	42.21	New Red Lion	14.31	01/08	13.30	Heathlanes	62.51	27/07	62.09
Dial Farm	25.80	03/07	25.65	Ampney Crucis	100.31	24/07	100.46	Nuttalls Farm	131.03	13/07	129.42
Rockley	136.08	17/07	133.14	Redbank	7.36	31/07	7.88	Bussels No. 7A	23.97	27/07	23.69
Little Bucket	74.48	01/08	68.23	Skirwith	130.44	26/07	130.26	Alstonfield	180.82	14/07	178.87
West Woodyates	78.51	31/07	76.90	Yew Tree Farm	13.79	28/07	13.11				

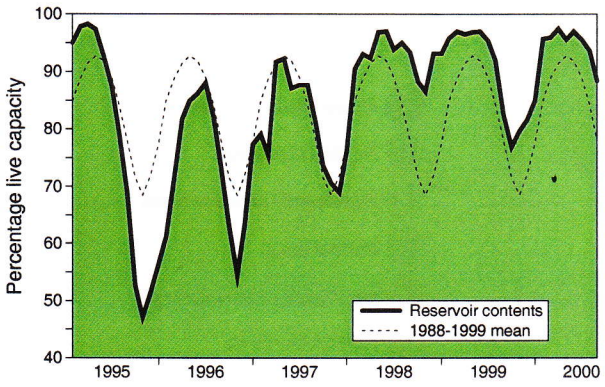
Levels in metres above Ordnance Datum



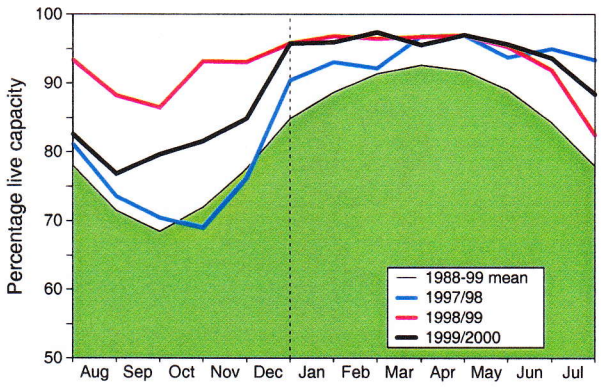
Groundwater levels - July 2000

The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs

Area	Reservoir	Capacity (Ml)	2000 Mar	Apr	May	Jun	Jul	Aug	Min. Aug	Year* of min
North West	N Command Zone	• 133375	100	92	88	79	77	64	38	1989
	Vyrnwy	55146	96	95	99	95	98	93	56	1996
Northumbrian	Teesdale	• 87936	100	94	100	100	93	87	45	1989
	Kielder	(199175)	(97)	(90)	(94)	(95)	(92)	(90)	66	1989
Severn Trent	Clywedog	44922	94	93	99	99	99	96	57	1989
	Derwent Valley	• 39525	100	100	100	100	92	86	43	1996
Yorkshire	Washburn	• 22035	100	94	100	99	90	83	50	1995
	Bradford supply	• 41407	99	93	99	92	90	76	38	1995
Anglian	Grafham	** (55490)	(90)	(94)	(96)	(91)	(92)	(93)	66	1997
	Rutland	**(116580)	(94)	(95)	(97)	(96)	(94)	(90)	74	1995
Thames	London	• 206399	95	96	97	96	96	88	73	1990
	Farmoor	• 13843	93	88	81	97	95	96	84	1990
Southern	Bewl	28170	98	98	100	100	100	93	45	1990
	Ardingly	4685	100	100	100	100	99	93	66	1995
Wessex	Clatworthy	5364	100	98	100	98	93	80	43	1992
	Bristol WW	• (38666)	(96)	(95)	(98)	(99)	(92)	(87)	53	1990
South West	Colliford	28540	100	100	100	100	98	95	47	1997
	Roadford	34500	100	97	99	97	96	94	46	1996
	Wimbleball	21320	100	100	100	100	96	89	53	1992
	Stithians	5205	100	98	98	92	84	74	39	1990
Welsh	Celyn and Brenig	• 131155	100	100	100	100	100	99	65	1989
	Brianne	62140	100	97	100	100	99	96	67	1995
	Big Five	• 69762	97	96	98	98	96	87	41	1989
	Elan Valley	• 99106	100	100	100	99	97	94	63	1989
East of Scotland	Edinburgh/Mid Lothian	• 97639	99	99	100	95	90	84	51	1998
	East Lothian	• 10206	100	97	100	99	96	93	72	1992
West of Scotland	Loch Katrine	• 111363	95	88	84	69	65	53	53	2000
	Daer	22412	100	97	97	90	80	66	58	1994
	Loch Thom	• 11840	100	97	92	79	69	59	59	2000
Northern Ireland	Silent Valley	• 20634	63	57	58	56	57	42	42	2000

()figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence **updated gross capacity

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The minimum storage figures relate to the 1988-2000 period only (except for West of Scotland where data commence in 1994). In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology - IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland), data for Northern Ireland are provided by the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, the West of Scotland and East of Scotland Water Authorities, and the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Rainfall

Most rainfall data are provided by The Met. Office (address opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Since the discontinuation of The Met. Office's CARP system in July 1998, rainfall figures have been provided by differing methods. Initial rainfall estimates for Scotland and the Scottish regions were derived by IH in collaboration with SEPA. In England and Wales, between July 1998 and May 1999, provisional rainfall figures derive from MORECS*. Beginning with the June 1999 report, provisional rainfall figures for England and Wales, the EA regions and Northern Ireland (from September 1999) have been produced by The Met. Office, National Climate Information Centre (NCIC), using a technique similar to CARP. An initiative is underway with The Met. Office to provide more accurate areal figures and, since October 1999, to include more raingauges in the analysis. A significant number of additional monthly rainfall totals are currently being provided by SEPA; over the coming months further monthly raingauge totals will be included for selected EA regions. Until the access to these additional data has stabilised the regional figures (and the return periods associated with them) should be regarded as a guide only.

*MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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The cooperation of all data suppliers is gratefully acknowledged.

Subscription

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Selected text and maps are available on the WWW at http://www.nwl.ac.uk/ih

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